



BUILD A BETTER HOME

CONTROLLING MOLD AND MILDEW

The discovery of mold in a building raises concerns about overall building performance. Mold growth is an indication of excessive moisture.

Fortunately, most moisture problems in buildings can be prevented or corrected with proper design, construction, and maintenance.

The Build A Better Home program from APA – The Engineered Wood Association is designed to provide builders and homeowners with the construction guidelines they need to protect homes against excessive moisture. The Build a Better Home Program includes design and installation publications that address the key elements in the building envelope and provide detailed examples of proper moisture control for the roof, walls, and foundations.

This publication provides general information on the characteristics of mold and mildew, conditions in which they grow, methods of prohibiting their growth, and resources for learning more about mold and its remediation.

Mold and mildew are potential health risks. The health aspects of mold and mildew are beyond the scope of this publication; however, the list of resources on the back page provides several excellent sources of information.

WHAT IS MOLD?

Molds are microscopic fungi that live off of organic matter rather than a photosynthetic process. The terms mold and mildew refer to the same class of fungi species and are terms commonly used interchangeably. Molds include many species, some of which have beneficial byproducts such as yeasts and penicillin.

On building materials, molds appear as woolly or powdery growths. Mold will grow on numerous building materials, including engineered wood products.

Mold may be mistaken for dirt or, conversely, dirt or other discolorations may be mistaken for mold. While a clinical verification for mold can be conducted at many labs, a simple test is to apply a few drops of a 5 percent solution of household bleach. When performing this test, it is important to use fresh bleach, since bleach deteriorates in potency when older than six months. Mold will usually lighten and nearly disappear within one to two minutes. Other substances that remain the same color are probably dirt or another form of discoloration. A publication from Forintek Canada Corporation referenced at the end of this brochure provides an excellent review of other forms of wood discoloration that may be mistaken for mold.

ENVIRONMENTS THAT SUPPORT MOLD GROWTH

Mold and mildew grow in conditions of ample moisture, darkness or low light, and stagnant airflow. Found nearly everywhere, mold spreads as airborne spores that begin to flourish when they find suitable growing conditions.

Mold needs the following conditions to grow:

Nutrients

Nearly any organic substance can provide the needed nutrients for mold, including wood, paper, plaster, cloth and dirt. Since even a thin film of dust will suffice, it will grow on nearly any surface, including plastics, metals and glass.

Moderate Temperatures

Mold and mildew grow easily at a temperature range of 68° F to 86° F. Since this is similar to the comfort range for humans, it is natural that homes provide a suitable temperature range for molds. Outside this temperature range, mold growth slows and may become inactive. Growth can resume when the temperature moderates.

Oxygen

Mold will not grow without oxygen.

Moisture

Mold growth requires high moisture conditions and becomes inactive when relative humidity drops below about 70 percent, but growth can resume if moisture is subsequently increased. The lower humidity threshold for mold growth has been debated, and published values can vary between 70 and 90 percent. But building science experts agree that the only practical method of controlling mold in buildings is to limit the moisture conditions.

CONTROL OF MOLD IN WOOD STRUCTURES

Since there are numerous materials in a building on which mold can grow, moisture control is widely recognized as the only viable method of controlling mold growth. Moisture control measures address:

- design of the structure and use of exterior moisture management systems, such as flashing.
- storage and handling of wood products throughout the distribution process and at the jobsite.
- maintenance and operation of the building, including control of interior humidity levels.

Effect of Mold and Mildew Growth on Wood Components

As an organic material, mold and mildew readily grow on wood if moisture is present. Mold grows on wood if exposed to water or prolonged humidity in excess of 70%.

Mold and mildew are of a different type of fungi than those that cause wood to rot. Unlike wood decay fungi, molds do not cause significant loss of the strength of wood products. Nonetheless, mold and mildew on wood may cause a health concern and indicate high moisture conditions are present. Prolonged periods of high moisture may also support the growth of wood decay fungi, which is another reason why it is important to follow proper methods of design, handling, installation and maintenance that will control the growth of mold and mildew.

Site layout, foundations and basements

Foundations and basements can be major sources of moisture and subsequently a source of mold growth. A study of indoor mold concentration by the State of Wisconsin Department of Health and Human Services found that the basement humidity level was linked to mold concentrations in the house. The following steps can reduce moisture in foundations and basements:

- Assure house site is positioned to provide drainage away from the structure.
- Provide proper ventilation of crawl spaces if appropriate for the climate. Codes generally require ventilation or other moisture control methods.
- Use a dehumidifier in damp basements. Be sure to drain and clean the dehumidifier frequently, since the drip pan can be a source of mold.
- Drain downspouts away from the foundation.
- Exhaust dryer and bathroom vents outside and not to the crawlspace or basement.
- See APA's Build a Better Home brochure for foundations for other specific moisture-control procedures.

Controlling Moisture in Walls

Walls are exposed to weather and are often subjected to moisture that intrudes past the cladding and into the wall system. Although moisture during construction eventually dries, the elevated moisture trapped in wall cavities can promote mold growth. After construction, walls are prone to leakage around windows, doors and other wall

penetrations. In addition, air leakage into the wall cavity may condense on cooler wall surfaces, trapping moisture in the wall cavity. The following steps can reduce moisture in walls:

- Use wide overhangs to protect windows, doors and other wall penetrations from leaks.
- Install proper flashing around windows, doors and wall penetrations.
- Design walls to prevent condensation, with consideration for the local climate.
- See APA's Build a Better Home brochure for walls for specific moisture control procedures

Controlling Moisture in Roofs

Roofs are exposed to moisture from leaks and from condensation in the attic. The following steps can reduce moisture in the roof system:

- Ventilate roofs or provide other moisture control procedures in accordance with local code requirements.
- Bathroom and dryer vents must not exhaust into the attic.
- Properly flash roof penetrations and roof-wall intersections to prevent leaks.
- See APA's Build a Better Home brochure for roofs for specific moisture control procedures.

Controlling moisture generated after occupancy

There are many sources of occupancy moisture that can elevate interior humidity, and cause mold to grow. The table to the right is a short list of interior moisture loads.

This moisture can become a problem if it is allowed to accumulate within the structure because of improper ventilation or moisture control. Following are tips for minimizing moisture buildup that can result in mold growth:

- Most codes include provisions for ventilation fans in kitchens and bathrooms. Use these fans when generating moisture.
- Install light switches that also activate the room's ventilation fan.
- Clothes dryer discharge air must be vented to the outside. These vents must be maintained to assure they are not clogged or torn.
- Use the home's air-to-air heat exchanger if available.
- See additional homeowner tips in the publication from the Institute for Home and Business Safety (IBHS), listed at the end of this brochure.

Cleaning Mold

There is a list of resources on page 4, including several that discuss proper remediation or cleaning of mold growth from building materials. It is universally agreed that the first step in any mold remediation is to identify and eliminate the source of moisture that caused the mold.

The New York City publication on mold remediation is widely heralded as a reference for mold remediation. This publication recommends removing mold with detergent followed by cleaning with a vacuum with a high efficiency particle arrestor (HEPA) filter.

Other resources applicable to wood products recommend that mold be removed or cleaned with commercial mold/mildew removers, following the manufacturer's directions, or with a solution of one part household bleach (5 percent sodium hypochlorite) mixed with three parts warm water. Never mix bleach with any cleansers containing ammonia. When using bleach, avoid breathing the vapors and contact with skin and eyes. Children and pets should be kept away from these products.

Floods represent an extremely high mold hazard. Mold can grow on building materials within 48 hours after floodwaters recede. The following publications provide guidance on dealing with flood reclamation:

- American Red Cross Publication 4477, Repairing Your Flooded Home
- Institute of Inspection, Cleaning and Restoration Certification Standard S500-94, Standard and Reference Guide for Professional Water Damage Restoration.

Moisture Sources	Quantity
Shower	0.5 pints per 5 minute shower
Clothes dryer	4.7 to 6.2 pints per load if vented indoors
Cooking dinner	1.2 pints (plus 1.6 pints if gas cooking) per family of four
Dishwashing	0.7 pints per family of four
House plants	0.9 pints per 6 plants

PUBLICATIONS AND OTHER RESOURCES

APA Publications

Proper design, construction, and building maintenance are all key factors in preventing high moisture conditions that are conducive to mold and mildew growth. Design recommendations in the APA publications listed below include provisions for moisture-resistant construction.

Build a Better Home – Foundations
(Form A520)

Build a Better Home – Walls (Form A530)

Build a Better Home – Roofs (Form A535)

Engineered Wood Construction Guide
(Form E30)

Controlling Decay in Wood Construction
(Form R495)

Moisture Control in Low Slope Roofs
(Form EWS R525)

Condensation – Causes and Control
(Form X485)

Other information on mold and wood products

Discoloration on Wood Products: Causes and Implications, Forintek Canada Corporation. See www.durable-wood.com

Mold, Housing and Wood, Western Wood Products Association. See www.wwpa.org

Mold, Moisture and Lumber, Southern Pine Council. See www.southernpine.com

Mold and Moisture, American Wood Council. See www.awc.org

Mold in Residential Buildings and Helping Your Buyers Understand Mold During the Building Process, National Home Builders Association Research Center. See www.toolbase.org

Mold and Mildew on Wood: Causes and Treatment and Recognize, Remove and Remediate Mold and Mildew, U.S. Forest Products Laboratory. See www.fpl.fs.fed.us

Information on mold, health effects, remediation and prevention

A Brief Guide to Mold, Moisture and Your Home, U.S. Environmental Protection Agency. This publication and links to other government web sites on mold are available at www.epa.gov/iaq/pubs/moldresources.html

Mold related issues are discussed on the website of the Center for Disease Control and Prevention (CDC). See www.cdc.gov/nceh/asthma_old/factsheets/molds/default.htm

Guidelines on Assessment and Remediation of Fungi in Indoor Environments. New York City Health Department. See www.nyc.gov/html/doh/html/epi/moldrpt1.shtml

Mold Allergy, Asthma and Allergy Foundation of America. See www.aafa.org

Mold: Cause, Effect and Response, Foundation of the Wall and Ceiling Industry. See www.awci.org

Is Your Home Protected from Water Damage? A Homeowner's Guide to Water Damage Prevention, Institute for Business and Home Safety (IBHS). See www.ibhs.org

ADDITIONAL INFORMATION

About APA – The Engineered Wood Association

APA – The Engineered Wood Association is a nonprofit trade association whose member mills produce approximately 60 percent of the structural wood panel products manufactured in North America.

The Association's trademark appears only on products manufactured by member mills and is the manufacturer's assurance that the product conforms to the standard shown on the trademark. That standard may be an APA performance standard, the Voluntary Product Standard PS 1-95 for Construction and Industrial Plywood, or Voluntary Product Standard PS 2-92, *Performance Standards for Wood-Based Structural-Use Panels*. Panel quality of all APA trademarked products is subject to verification through an APA audit.

APA's services go far beyond quality testing and inspection. Research and promotion programs play important roles in developing and improving panel and engineered wood systems, and in helping users and specifiers better understand and apply products.

For additional information on wood construction systems, contact APA – The Engineered Wood Association, P.O. Box 11700, Tacoma, Washington 98411-0700.

MORE INFORMATION ONLINE

Visit APA's web site at apawood.org for more information on engineered wood products, wood design and construction, and technical issues and answers.

Online publication ordering and free downloads are also available through the web site.

We have field representatives in many major U.S. cities and in Canada who can help answer questions involving APA trademarked products. For additional assistance in specifying APA engineered wood products, contact us:

APA – THE ENGINEERED WOOD ASSOCIATION HEADQUARTERS

7011 So. 19th St. ■ P.O. Box 11700
Tacoma, Washington 98411-0700
(253) 565-6600 ■ Fax: (253) 565-7265

Web Address:
@

www.apawood.org

PRODUCT SUPPORT HELP DESK

(253) 620-7400

E-mail Address: help@apawood.org

The product use recommendations in this publication are based on APA – The Engineered Wood Association's continuing programs of laboratory testing, product research, and comprehensive field experience. However, because the Association has no control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility for product performance or designs as actually constructed. Because engineered wood product performance requirements vary geographically, consult your local architect, engineer or design professional to assure compliance with code, construction, and performance requirements.

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